CLAIMS

What is claimed is:

1. An isolated polynucleotide that encodes (1) a first polypeptide of at least 361 amino acids, and having a sequence identity of at least 75% based on the Clustal method of alignment when compared to a second polypeptide having all amino acid sequence of SEQ ID NO:2, or (2) a third polypeptide of at least 114 amino acids and having a sequence identity of at least 75% identity based on the Clustal method of alignment when compared to a fourth polypeptide selected from the group consisting of SEQ ID NOs:4 and 6.

2. A polynucleotide sequence of Claim 1, wherein the sequence identity is at least 80%.

3. A polynucleotide sequence of Claim 1, wherein the sequence identity is at least 90%.

4. The polynucleotide of Claim 1 wherein the first polypeptide has an amino acid sequence if SEQ ID NO:2 and is selected from the third polypeptide group consisting of SEQ ID NOs:4 and 6.

5. The polynucleotide of Claim 1, wherein the polynucleotide comprises a nucleotide sequence selected from the group consisting of SEQ ID NOs:1, 3, and 5.

6. The polynucleotide of Claim 1, wherein the first polypeptide is a Δ^4-16:0-ACP desaturase and the third polypeptide is an acyl carrier protein.

7. An isolated complement of the polynucleotide of Claim 1, wherein
   (a) the complement and the polynucleotide have the same number of nucleotides, and
   (b) the nucleotide sequences of the complement and the polynucleotide have 100% complementarity.

8. An isolated nucleic acid molecule that:
   (a) comprises at least 300 nucleotides and
   (b) remain hybridized with the isolated polynucleotide of Claim 5 under a wash condition of 0.1X SSC, 0.1% SDS, and 65°C.

9. A cell comprising the polynucleotide of Claim 1.

10. The cell of Claim 9, wherein the cell is selected from the group consisting of a yeast cell, a bacterial cell and a plant cell.

11. A transgenic plant comprising the polynucleotide of Claim 1.

12. A method for transforming a cell comprising introducing into a cell the polynucleotide of Claim 1.

13. A method for producing a transgenic plant comprising (a) transforming a plant cell with the polynucleotide of Claim 1, and (b) regenerating a plant from the transformed plant cell.

14. A method for producing a polynucleotide fragment comprising:

(a) selecting a nucleotide sequence comprised by the polynucleotide of Claim 1, and

(b) synthesizing a polynucleotide fragment containing the nucleotide sequence.

15. The method of Claim 14, wherein the fragment is produced *in vivo*.

16. An isolated polypeptide selected from the group consisting of:

(a) a first polypeptide comprising at least 361 amino acids and having a sequence identity of at least 75% based on the Clustal method compared to the amino acid sequence of SEQ ID NO:2, and

(b) a second polypeptide comprising at least 114 amino acids and having a sequence identity of at least 75% based on the Clustal method compared to an amino acid sequence selected from the group consisting of SEQ ID NOs:4 and 6.

17. The polypeptide of Claim 16, wherein the sequence identity is at least 80%.

18. The polypeptide of Claim 16, wherein the sequence identity is at least 90%.

19. The polypeptide of Claim 16 wherein the polypeptide has a sequence selected from the group consisting of SEQ ID NOs:2, 4, and 6.

20. The polypeptide of Claim 16, wherein the first polypeptide is a Δ^4-16:0-ACP desaturase and the second polypeptide is an acyl carrier protein.

21. A chimeric gene comprising the polynucleotide of Claim 1 operably linked to at least one suitable regulatory sequence.

22. A method for altering the level of Δ^4-16:0-ACP desaturase or acyl carrier protein expression in a host cell, the method comprising:

(a) Transforming a host cell with the chimeric gene of Claim 21; and

(b) Growing the transformed cell in step (a) under conditions suitable for the expression of the chimeric gene.

23. Seeds obtained from the plant of Claim 11.

24. Oil obtained from the seeds of Claim 23.

25. A method for producing petroselinic acid in a plant, the method comprising:

(a) transforming a plant with a chimeric gene comprising the isolated nucleic acid fragment of Claim 1 or a functionally equivalent subfragment thereof or a complement thereof operably linked to suitable regulatory sequences;

(b) growing the transformed plant under conditions suitable for the expression of the chimeric gene; and

(c) selecting those transformed plants producing petroselinic acid.

26. A method for producing seed oil containing fatty acids having petroselinic acid in the seeds of plants which comprises:

(a) transforming a plant with a chimeric gene comprising the isolated nucleic acid fragment of Claim 1 or a functionally equivalent subfragment thereof or a complement thereof operably linked to suitable regulatory sequences;

(b) growing a fertile mature plant from the transformed plant cell of step (a);

(c) screening progeny seeds from the fertile plants of step (b) for altered levels of acetylenic fatty acids; and

(d) processing the progeny seed of step (c) to obtain seed oil containing petroselinic acid.